



# 3 V SILICON RFIC FREQUENCY UPCONVERTER

## UPC8163TB

### FEATURES

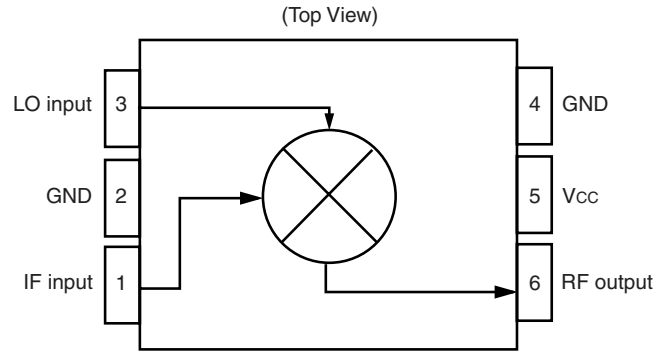
- **RECOMMENDED OPERATING FREQUENCY:**  
 $f_{RFOUT} = 0.8 \text{ GHz to } 2.0 \text{ GHz}$   
 $f_{IFIN} = 50 \text{ MHz to } 300 \text{ MHz}$
- **SUPPLY VOLTAGE:**  
 $V_{CC} = 2.7 \text{ to } 3.3 \text{ V}$
- **HIGH DENSITY SURFACE MOUNTING:**  
 6-pin super minimold package
- **HIGH IP<sub>3</sub>:**  
 $OIP_3 = +9.5 \text{ dBm @ } f_{RFOUT} = 900 \text{ MHz}$
- **MINIMIZED CARRIER LEAKAGE:**  
 Due to double balanced mixer

### DESCRIPTION

NEC's UPC8163TB is a silicon RFIC designed as a frequency upconverter for cellular/cordless telephone transmitter stages, and features improved intermodulation. This device is housed in a 6 pin super mini mold or SOT-363 package making it ideal for reducing system size. The UPC8106TB is manufactured using NEC's 20 GHz fr NESAT™ III silicon bipolar process.

NEC's stringent quality assurance and test procedures ensure the highest reliability and performance.

### BLOCK DIAGRAM



### APPLICATIONS

- Digital Cellular/Cordless Phones

### ELECTRICAL CHARACTERISTICS

( $T_A = 25^\circ\text{C}$ ,  $V_{CC} = V_{RFOUT} = 3.0 \text{ V}$ ,  $f_{IFIN} = 240 \text{ MHz}$ ,  $P_{LOIN} = -5 \text{ dBm}$  unless otherwise specified)

PART NUMBER PACKAGE OUTLINE			UPC8163TB S06		
SYMBOLS	PARAMETERS AND CONDITIONS	UNITS	MIN	TYP	MAX
I <sub>CC</sub>	Circuit Current (no signal)	mA	11.5	16.5	23
CG	Conversion Gain	$f_{RFOUT} = 0.9 \text{ GHz}$ , $P_{IFIN} = -30 \text{ dBm}$	6	9	12
		$f_{RFOUT} = 1.9 \text{ GHz}$ , $P_{IFIN} = -30 \text{ dBm}$	4	7	10
P <sub>SAT</sub>	Saturated Output Power	$f_{RFOUT} = 0.9 \text{ GHz}$	-1.5	0.5	
		$f_{RFOUT} = 1.9 \text{ GHz}$	-4.5	-2	
OIP <sub>3</sub>	Output third Order Intercept Point, $f_{IFIN1} = 240 \text{ MHz}$ $f_{IFIN2} = 240.4 \text{ MHz}$ $P_{IFIN} = -20 \text{ dBm}$	$f_{RFOUT} = 0.9 \text{ GHz}$		+9.5	
		$f_{RFOUT} = 1.9 \text{ GHz}$		+6.0	
NF	SSB Noise Figure	$f_{RFOUT} = 0.9 \text{ GHz}$		12.5	
		$f_{RFOUT} = 1.9 \text{ GHz}$		12.5	

# UPC8163TB

## ABSOLUTE MAXIMUM RATINGS<sup>1</sup> (T<sub>A</sub> = 25°C)

SYMBOLS	PARAMETERS	UNITS	RATINGS
V <sub>CC</sub>	Supply Voltage <sup>2</sup>	V	3.6
P <sub>T</sub>	Total Power Dissipation <sup>3</sup>	mW	200
P <sub>IN</sub>	Input Power	dBm	+10
T <sub>OP</sub>	Operating Temperature	°C	-40 to +85
T <sub>STG</sub>	Storage Temperature	°C	-55 to +150

Notes:

1. Operation in excess of any one of these conditions may result in permanent damage.
2. T<sub>A</sub> = 25°C, pins 5 and 6.
3. Mounted on a double-sided copperclad 50x50x1.6 mm epoxy glass PWB, T<sub>A</sub> = 85°C).

## RECOMMENDED OPERATING CONDITIONS

SYMBOLS	PARAMETERS	UNITS	MIN	TYP	MAX
V <sub>CC</sub>	Supply Voltage <sup>1</sup>	V	2.7	3.0	3.3
P <sub>LOIN</sub>	Local Input Level <sup>2</sup>	dBm	-10	-5	0
f <sub>RFOUT</sub>	RF Output Frequency <sup>3</sup>	GHz	0.8	-	2.0
f <sub>IFIN</sub>	IF Input Frequency	MHz	50	-	300
T <sub>OP</sub>	Operating Temperature	°C	-40	+25	+85

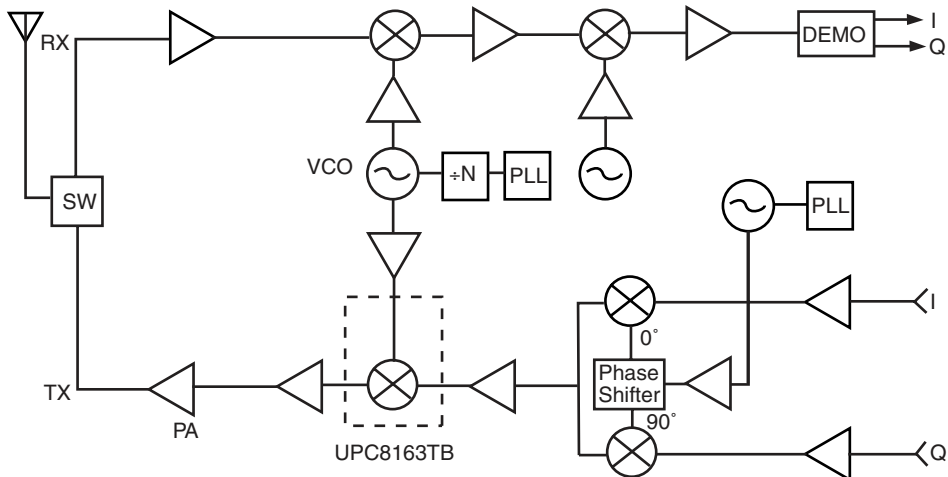
Notes:

1. Same voltage applied to pins 5 and 6
2. Z<sub>S</sub> = 50 Ω (without matching)
3. With external matching circuit

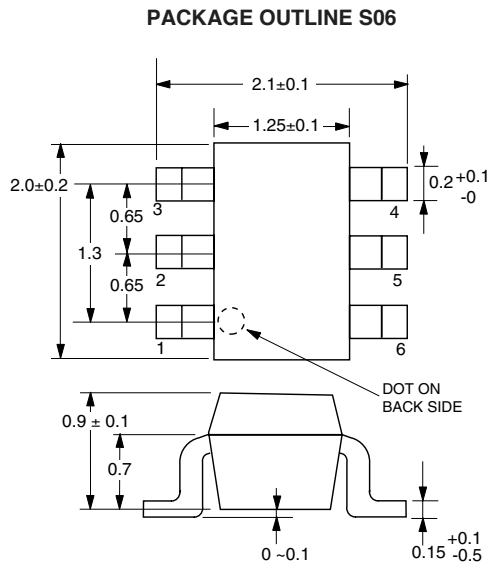
## PIN FUNCTIONS

Pin No.	Pin Name	Applied Voltage	Pin Voltage	Description	Equivalent Circuit
1	IFINPUT	—	1.2	This pin is the IF input to double balanced mixer. The input is a high impedance.	
2, 4	GND	0	—	GND pin. Ground pattern on the board should be as wide as possible. Trace length should be kept as short as possible to minimize ground impedance.	
3	LOINPUT	—	2.1	LO input pin. Recommended input level is -10 to 0 dBm.	
5	V <sub>CC</sub>	2.7 to 3.3	—	Supply voltage pin.	
6	RFOUTPUT	Same bias as V <sub>CC</sub> through external inductor	—	This pin is the RF output. This pin is designed as an open collector. Due to the high impedance output, this pin requires an external LC matching circuit.	

## APPLICATION EXAMPLE

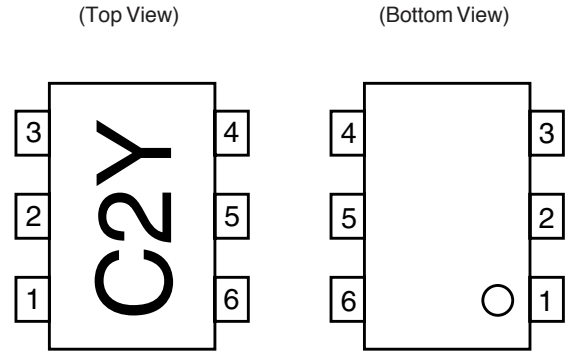


**OUTLINE DIMENSIONS** (Units in mm)



Note:  
All dimensions are typical unless otherwise specified.

**LEAD CONNECTIONS**



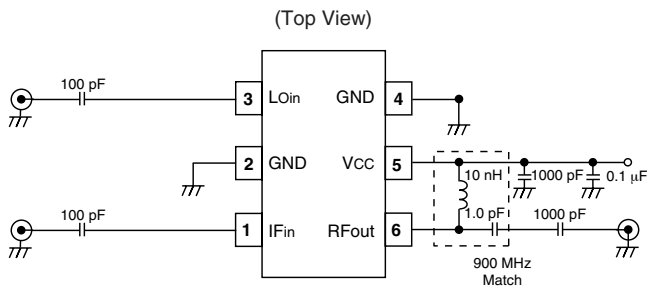
1. IF INPUT
2. GND
3. LO INPUT
4. GND
5. VCC
6. RF OUTPUT

**ORDERING INFORMATION**

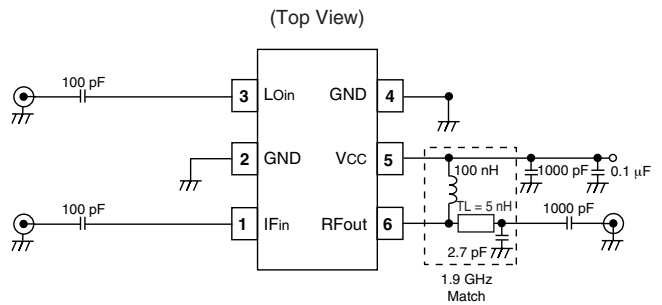
PART NUMBER	QUANTITY
UPC8163TB-E3-A	3K/Reel

Note: Embossed tape 8 mm wide. Pins 1,2,3 face tape perforation side.

**TEST CIRCUIT 1** (RF<sub>OUT</sub> = 900 MHz)



**TEST CIRCUIT 2** (RF<sub>OUT</sub> = 1.9 GHz)



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DATA SUBJECT TO CHANGE WITHOUT NOTICE

02/14/2000

Subject: Compliance with EU Directives

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Restricted Substance per RoHS	Concentration Limit per RoHS (values are not yet fixed)	Concentration contained in CEL devices	
		-A	-AZ
Lead (Pb)	< 1000 PPM	Not Detected	(*)
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Cadmium	< 100 PPM	Not Detected	
Hexavalent Chromium	< 1000 PPM	Not Detected	
PBB	< 1000 PPM	Not Detected	
PBDE	< 1000 PPM	Not Detected	

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